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Journal of the Society of Arts.

FRIDAY, APRIL 24, 1863.

THE SOCIETY'S MEMORIAL OF THE PRINCE CONSORT.

The following circular, with an abstract of the proceedings of the General Meeting held on the 7th Feb., has been issued to the members:—

Society of Arts, Adelphi, London, W.C., Feb., 1863.

Sir,—I am directed to bring to your notice the subjoined proceedings of a Special General Meeting of this Society, held on Saturday, the 7th instant.

Should you desire to have your name placed on the list of subscribers, I shall feel obliged by your filling in the accompanying paper, and returning it to me, with your subscription, which may be in the form of a post office order or cheque, made payable to the Financial Officer, Mr. Samuel Thomas Davenport, and crossed Coutts and Co. I am, Sir, your obedient servant,

P. LE NEVE FOSTER, *Secretary.*

The subscription of each member is limited to one guinea.

The following additional names have been received up to the 23rd inst.:—

Bax, Edward	1	1	0
Browne, Henry	1	1	0
Browne, William	1	1	0
Dell, William	1	1	0
Denham, William Graham	1	1	0
Hutton, Thomas	1	1	0
Jackson, Frederick Rowland	1	1	0
Jowett, John	1	1	0
Lemann, Francis H.	1	1	0
Mackenzie, John Henry	1	1	0
Mitchell, Rev. Muirhead	1	1	0
Palmer, Ebenezer	0	10	6
Palmer, Edward Howley	1	1	0
Sandon, Viscount, M.P.	1	1	0
Smith, James	1	1	0
Tanqueray, Charles	1	1	0
Tansley, Alfred John	0	10	6
Thompson, Harry S., M.P.	1	1	0
Thorne, Augustus	1	1	0
Welch, John K.	1	1	0
Williams, H. R.	1	1	0

COMMITTEES OF REFERENCE.—EDUCATION.

The Committee on Education met on Friday, the 17th inst. Sir Thomas Phillips, Chairman of the Council, in the chair.

The Chairman explained the objects of the Committee, and invited members to offer any observations upon what the Society had already done to promote education, and to suggest any further steps which it might appear desirable should be taken in this direction. He would call upon his friend Mr. Chester to make a few remarks.

Mr. Harry Chester said it was rather the idea of the Council, in calling this meeting, to get suggestions from those who were not members of the Council. All present would no doubt be aware of the operations which the Society had of late years carried out with regard to education. This was not a new field to them. He found, from the earliest period of its history, the Society was in the habit of offering encouragement to education. Mr. Chester proceeded to describe the present plan of the Society's operations with regard to adult education, and the organisation which had been carried out for the Society's examinations, and he went on to remark, that the success of the measures they had taken had been, he thought, considerable. There had been a gradual increase in the numbers who availed themselves of this system of examination. They had of late given a great deal of attention to the establishment of Elementary Examinations by the various Local Educational Boards, so that children between the age of 12 and 16, and older persons, whose early education had been neglected, might be taken up at a low point of education and carried on to a higher. There was one great difficulty in connection with this system, which was, that it was very complicated. He confessed one of the greatest services that could be rendered to the system of the Society's Examinations would be a suggestion as to a mode in which the plan could be simplified. It was, however, of importance not too much to centralise the operations, but rather to enlarge the growth of Local Boards in all parts of the country, and that they should depend upon the Society of Arts no more than was necessary to give vitality and success to the system. Looking at the subject in that point of view, he thought much good would result from an extension of the plan of central unions of institutions as had been done in Yorkshire and South Staffordshire, and under the exertions of his hon. friend, Mr. Best, in the southern counties, from which representatives were appointed to sit upon the Central Committee. In that manner all the various bodies throughout the country might be represented, and the whole thing, he thought, much simplified. They might thus have but one set of previous examinations, and one set of final examinations. He might mention that this year an Association, called the Metropolitan Association for Promoting the Education of Adults, had been established in London, which was "in union," as so many Institutions were, with the Society of Arts. This Association had introduced a new feature into their examinations, which he considered was of value. The Society of Arts, representing as it did persons of all religious persuasions, could not conduct any examination in religious knowledge. It had, however, occurred to the Metropolitan Association to make application to the Bishops of London and Winchester to hold examinations on religious subjects, and they had consented to do so. This, like all the other examinations, would be of a voluntary character, but those who desired it, having previously obtained a certificate from the Society of Arts, or some body in connection with it, might present themselves in this class of examinations, and he considered this an important addition to the system. This could not, however, be done by the agency of the Society of Arts, but by the local associations themselves.

Dr. Waddilove had not himself more than a general knowledge of the operations of the Society in connection with education, but he presumed they consisted chiefly in examinations. The examination was no doubt the culminating point as the test of education, and it afforded an inducement to people to educate up to that test. He thought it desirable not only that they should have these examinations, but that the Society should lay down some general line of education to be adopted by the persons they intended hereafter to examine, which should serve as some sort of outline of the course of education which was considered desirable.

Mr. Chester said that was already done to a certain extent. The programme issued by the Society contained twenty-nine subjects for examination, giving, he thought, sufficient scope for variety, and allowance for diversity of tastes. They did not require, as in the universities, that a man should go through a complete course of education; but it was open to him to choose any four subjects out of the twenty-nine on which he desired to be examined. By this means he went on year by year adding to his store of knowledge, either by the further study of the subjects on which he had been previously examined, so as to qualify himself for a higher certificate, or by entering upon fresh branches of study.

Rev. R. Whittington thought that the Society of Arts had gone as far as it could in suggesting the course of education that should be adopted. The object the Society had in view was not to teach, but to test education. Mr. Whittington then referred to some matters of detail in the arrangement of the Examinations, and a conversation took place, in which various members of the Committee took part.

Mr. Watkins inquired whether the Society's system of Examinations was confined to the male sex?

The Chairman replied that not only were females allowed to come up for examination, but last year a lady was successful in gaining the highest prize in English literature.

Mr. Watkins thought that the present system of female education in this country was extremely defective. If the Society offered a special prize for females in the higher branches of knowledge, it would tend to the welfare of education generally.

The Hon. and Rev. S. Best said the suggestion just thrown out was a most important one, because they must look upon women as the future educators of the country. He approved of the suggestion of a special prize for the encouragement of the education of females.

Dr. Yeats said, as a member of the Board of Examiners of Queen's College, he must take exception to the sweeping condemnation that had been passed by a preceding speaker upon female education in England. At Queen's College there were ample opportunities for females acquiring a good education, and the influence of that institution ramified in all directions.

Mr. Watkins said he was quite aware of the admirable system pursued at Queen's College, and he excepted that institution from his remarks; but in most private schools there was no system of education at all.

Dr. Yeats, after giving some account of his own educational experience both in this country and abroad, said that the difficulty with which he had had chiefly to contend was one which it seemed to him the Society of Arts might greatly assist in overcoming; it was that of interesting the parent in the business of the child. He thought branch associations might be formed in every town and village, which should associate themselves with the great society, and be in frequent communication with it, especially upon this one object of education. He thought the important thing in education was to find out what the parents themselves wanted. Dr. Yeats, in conclusion, suggested that the offering a prize for a good history of industry would be worthy the attention of the Society.

After some remarks by Mr. J. M. Wade, and the Rev. R. Whittington,

Dr. Yeats expressed his opinion that much good would be done by the larger distribution of the *Journal* of the Society throughout the country. He had been told by two humble inventors of useful articles that if they had access to the *Journal* it would be of unquestionable use to them and to their families.

Mr. George White urged the importance of making the educational operations of the Society more largely known, particularly in the metropolis.

Mr. Chester, returning to the subject of the encouragement of the education of women, said that he thought much might be done by the establishment of a Central Board for testing their knowledge, and granting them special certificates.

Mr. James Heywood agreed with the importance of the subject of the improvement of female education in this country. He recollected on a late occasion a lady, who was a student in the London University, wished to matriculate for degrees, and upon a division of the senate on the question as to the admission of females to degrees, the numbers were 10 for, and 10 against; and Earl Granville, who was the chairman on the occasion, gave the casting-vote against the proposition, so that the lady in question was not admitted to degrees; but, an equal division of votes having taken place, he did not despair that the question might be revived with a different result. He agreed with the suggestion of Mr. Chester, that they might have a Special Board of Examiners for females.

Rev. James Ridgway thought there was some danger of falling into the error that the whole object of education was to push the intellect to the furthest possible extent, without thinking how that education might act practically upon the future prospects of life, and though the universities might be useful for females in some cases, it was to be considered how far such education as was there imparted was calculated to render them useful to their fellow creatures in after-life.

Rev. R. Whittington wished to state that for a small fee women could be examined at Queen's College, where certificates almost equal to degrees were given which had their proper value in the educational world. He did not at present see that examinations of females by the Society of Arts would afford advantages over what was now done at Queen's College.

The Hon. and Rev. S. Best believed that neither Queen's College nor King's College embraced the classes to whom the Society's examinations were directed.

Rev. R. Whittington said that for a fee of 5s. any person could be examined at Queen's College.

After some further conversation the proceedings terminated.

NINETEENTH ORDINARY MEETING.

Wednesday, April 22, 1863.

The Nineteenth Ordinary Meeting of the One Hundred and Ninth Session was held on Wednesday, the 22nd inst., Rear-Admiral the Hon. Joseph Denman, F.R.G.S., in the chair.

The following candidates were proposed for election as members of the Society :—

Baxter, Richard	14, Porchester-square, W.
Cook, Dutton	4, Raymond-buildings, Gray's-inn, W.C.
Costa, Michael	54, Eccleston-square, S.W.
Cox, Edward	102, Chancery-lane, W.C.
Davidson, Septimus	22, Basinghall-street, E.C.
Dean, Samuel	5, Cleveland-gardens, Hyde-park, W.
Denison, Alfred	6, Albemarle-street, W.
Dicker, John Campbell	10, Craig's-court, Charing-cross, S.W.
Harwood, H. Harwood	29, Cleveland-square, Hyde-park, W.
Hayes, George, M.D.	66, Conduit-street, Bond-street, W.
Lake, George Walter Gidley	13, Finsbury-place South, E.C.

The following Candidates were balloted for and duly elected members of the Society :—

Benbow, Vernon	69, Russell-square, W.C.
Carter, Robert	41, Victoria-street, Westminster, S.W., and The Grove, Epsom.

Cavell, Edward Strutt ...	6, Great Coram-street, and 5, Gray's-inn-place, W.C.
Child, Henry William Grace	27, Scarsdale-villas, Kensington, W.
Heaton, Clement	24A, Cardington-street, Hampstead-road, N.W.
Mappin, Joseph C..........	Clapham-park, S.
Ridsdale, Joseph	Montpelier House, Tufnell-park, N.
Tunstall, Wm. Croudson.	Gloucester.

The Paper read was—

ON THE CONSTRUCTION OF TWIN SCREW STEAM-SHIPS.

By Commander T. E. Symonds, R.N.

It may be urged, and with some show of reason, that the subject I have chosen is too comprehensive, too full of matter of vital importance, to be treated in the limited period permitted by this Society, but, while perfectly aware of this, as well as of my own incompetency to deal with it as it deserves, I shall endeavour to treat it generally, dwelling on those points which, as a seaman, I consider merit a prominence that has not hitherto been given to them, and particularly calling attention to a system, the practical application of which has of late borne out all I have advanced in its favour, and that bids fair to revolutionise the present method of propulsion.

Being a seaman, and not presuming to be, in the fullest acceptation of the term, a naval architect, there are those who I know will, on principle, object to my thus venturing on a province they hold to be exclusively their own. However that may be, I consider it a legitimate undertaking for a naval officer, who has given the subject much attention, to venture opinions founded on practical results that have come under his observation, especially at a time when shipbuilders themselves are so much at variance on the form, construction, and system of propulsion which is best to be adopted in the future.

Previously to entering upon the subject of my paper, I am desirous of stating that the principles of construction I am about to explain are those of a man well known to this Society for the distinguished services he has rendered his country. I refer to my honoured friend, the veteran engineer, Mr. Richard Roberts, to whose genius we are already indebted for many of those machines which have contributed so largely to the perfection of manufactures, whether dealing with the surface of the hardest metal or with the most fragile fibre. It has been my privilege to be associated with him in carrying out his principles of constructing twin screw steam-ships, a system I have long believed in, but never saw a method of properly applying, until I became acquainted with his plans, to which I have made such additions and alterations as my professional experience led me to believe were necessary.

I must beg to be understood that I do not claim, either for Mr. Roberts or myself, the invention of propulsion by two screws, but simply a method of applying them by which their greatest useful effect may be developed.

Notwithstanding the marked improvement that has taken place in shipbuilding during the last quarter of a century, we do not appear to have made that progress in the application of the screw as a propeller which might have been anticipated. Nor have we improved the manœuvring and steering qualities of our ships in the slightest degree, although the necessity for it increases with the larger dimensions on which they are now constructed.

Whether or no this proceeds from the absence of practical acquaintance with the contingencies which seamen alone can properly estimate, it is an undoubted fact that many of our large ships are still sent to sea in most other respects perfect, but lacking those vital qualities on which their successful performance mainly depends, the absence of which is seldom strikingly manifested till the hour of peril arrives, and the oft-repeated tale of disaster conveys to us the imperfection of existing arrangement. It has I think been unwisely recommended to increase the area of rudder considerably, and apply steam or hydraulic power to actuate it, thus effecting by overwhelming force that which may be attained by turning the propelling power to account as a steering agent, which proceeding from the source of motion, must act more directly and suddenly on the ship, as in the twin screws. I believe we have arrived at a point beyond which it would be unsafe to increase the size of the rudder.

We have been engaged during the last 20 years, and are still occupied, in testing the power of the screw, but we have comparatively ignored the question of its proper position in a ship whereby to secure its most useful effect as a propeller, and to enable it to fulfil its duties under all circumstances of difficulty in which a ship may be placed.

In one of the latest reports of these trials we are reminded of the impossibility of such a ship as the *Emerald*, when propelled by a single screw, being able to enter even such a harbour as New York, and by the aid of her own powers turn and go out to sea again, under ordinary circumstances; what would be her fate if placed in a position of danger requiring that nicety of manœuvring which could alone save her from destruction, and which the costly character of her equipment entitles us to expect?

In these tests of the screw we have learned much that is interesting, and one important fact, which constantly recurring accidents should have deeply impressed on our minds, namely, that a few turns of a rope's-end will fix the screw, as in the *Royal Charter* and many other cases, and a first-class ship with all her magnificent engines become helpless on the water, so far as her machinery is concerned, and unless under a very different rig to that now applied to our ships of war, equally so under canvas, in a military point of view, some of them taking twenty minutes to stay and from thirty to forty to wear.

If ships are still to retain their sails and to be efficient men-of-war, they must do so to a greater extent than at present; some remedy must be found for this defect, otherwise a very few minutes in action will decide their fate.

In addition to the manifold imperfections attending the present method of fitting the screw, which have received many illustrations in our war ships of late, there are practical difficulties of construction (which I have constantly urged) that are now beginning to be admitted. For instance, the enormous and costly forgings for the stern-posts, weighing some 40 to 50 tons each, taking a year to prepare, and then perhaps found faulty at last, as was the case in one instance, the difficulty of securing these massive forgings to the plates of the stern, and the imperfect character of the fastening when fixed there, the great unsupported weight at the extremity, already considerably weakened by the screw aperture, all form objections of a grave character that cannot be overlooked.

The exposed condition of the after stern-post, rudder, and screw to injury from shot, rams, and other causes, and the liability of the screw to foul, are points meriting more attention than they have received. It is yet an open question how far the stoppage of the *Orpheus's* engines may be attributable to the after stern-post striking the ground, thereby throwing the screw shaft out of centre. No practical plans have hitherto been devised for their protection. Those which have appeared involve either a malformation of the after body, as may be seen in recent models, which will incur loss of speed, or auxiliary appliances of a complicated character which are calculated to increase rather than diminish the evil. I have on many occasions recommended the form of propeller shown in the diagrams, which is decidedly non-fouling. It is lighter, and will, I believe, on experiment, prove quite as effective as any of those forms now used. A model of this propeller is on the table, showing a method by which it may be readily withdrawn without disturbing the main shaft. Furthermore, I contend that, no matter how perfect the form of the ships may be, the position of the screw in the centre of the run is not calculated to develop its greatest useful effect as it works in the disturbed water or eddy caused by the passage of the ship, and, being so near the surface, is constantly lifted out of the water, which involves loss of power, and causes vibration by the unequal action of the upper and lower blade. Apart from the causes ordinarily considered to produce vibration, I believe that much is due to the resistance met with by the after stern-post in its passage through the water at high speed, which produces a tremulous motion. This may be noticed in a minor degree in a post standing in a swift current. This primary cause is greatly increased by the action of the screw in throwing the water against the top and bottom of the rudder twice in every revolution. In support of this view, I may mention that in the *Prince Albert*, and other single screw steamers having their rudders before the screw, no perceptible vibration takes place. The screw aperture in the dead wood being dispensed with in these vessels, their steering power is as perfect as in a sailing ship.

Vibration is by no means the least of the many serious objections to the single-screw system, and is perhaps the strongest argument that can be adduced against building wooden ships, as it causes them to leak to such an extent as to necessitate constant caulking and repairs. The *Orlando* and several of our large wooden frigates furnish ample proof of this; in the former, the vibration was of such a character as absolutely to endanger the masts and threaten to throw the men out of the rigging. Iron ships are by no means exempt from its destructive effects, as is frequently seen in their loosened rivets, and other unmistakeable symptoms. Another objection to the single screw is its tendency to throw the ship out of her direct course, by its acting to the right or left, according as the screw is right or left-handed; this involves a corresponding opposite action of the rudder, which must reduce speed, rudder and screw being in conflict. This is entirely obviated in the twin screw system, as the screws being right and left they turn in opposite directions, and thus correct that deviation from a right line which either would cause separately. Having thus considered some of the drawbacks attendant upon the single screw system, I will, with your permission, enter upon the application of "Twin," or as they are sometimes called, "Double Screws."

We are, I believe, indebted to Captain Carpenter, R.N., for first introducing the plan of working two screws, for which he obtained a patent. In this instance however, and until a date subsequent to Mr. Roberts' invention, they were driven by the same engine, and, therefore, could not be used independently, the leading and most valuable feature of the principle being entirely overlooked. This Mr. Roberts supplied by the simple application of separate and independent engines to each shaft, by which the screws are driven independently of each other, and a perfect steering power is thus obtained with the ship going either ahead or astern, by increasing or decreasing the velocity of either screw without any assistance from or use of the rudder. By reversing the action of one screw the ship is turned round on her centre (*i.e.* in her own length), if necessary, as upon a pivot, the ship thus becoming a turntable, unerring in its action and not liable to disarrangement.

The possibility of executing these most important manœuvres with twin screws was much questioned, if not absolutely denied, by many scientific and practical men, when I read a paper on the subject at the Royal United Service Institution, in March last year, the substance of which was published in the *Journal* of this Society in July, 1862. The statements I then made were the result of practice, which has since been satisfactorily confirmed in the presence of many distinguished and competent persons on board Messrs. Dudgeon's celebrated twin-screw vessels *Flora* and *Kate*, whose performances have convinced all but the ultra-sceptical, and may be said to have introduced a new era in ocean steam navigation in this country.

It may be interesting as well as instructive to learn that this success in the twin-screw system is not confined to our side of the Atlantic. Numerous vessels of the navy and mercantile marine of America are now fitted on this system; in fact, those destined to act in narrow waters are considered comparatively useless without it. In a recent reliable account from America, the loss of the iron-clad ram *Indianola* is entirely attributed to her "inability to manœuvre," falling an easy prey to two small gun boats having that power in a high degree. The writer states, "Now that she has gone we see her defect plainly enough, and war has taught the lesson, she could not control her position. The two small vessels could run round her, while she could not turn; they could thus ram her first on one side, then on the other, till the mailed giant was beaten to death, while at any time one blow from her prow would have crushed both of her assailants could she have got at them." He further asks, "How are we building our ocean rams? Have they the means of turning at pleasure? If not they are likely to fall victims to smaller craft, as did the *Indianola*." A vessel 400 feet long cannot be turned in narrow waters with a single screw propeller, and would certainly be destroyed by a shot-proof ram of 100 feet, which could rapidly change its position.

The fate of the *Indianola* has thus been presented to us as a warning, in almost the same words, and in the manner I predicted last year, and carries with it the conviction that one of the first conditions to be obtained in a ram or any other war ship is power to manœuvre at will, for without that power, however great and strong otherwise, she is next to useless in the presence of an enemy having it.

The *Nangatuck*, American gun boat, of 100 feet long by 20 broad, drawing 5 feet of water ordinarily, 7 feet when settled in the water, by filling her cells, at public experiments repeatedly turned end for end in one minute 15 seconds. She is fitted with twin screws, and had a 6½ in. Parrot's gun, throwing 100lb. shot, on a fixed carriage. There being no possibility of moving the gun laterally, except by moving the vessel, this was done with perfect ease, the vessel becoming the turn-table, actuated by the two screws, by which means accurate line firing was made.

Another instance from the same quarter is that of the *John Nelson*, a twin screw steamer, 225 feet long, used for transporting the mail trains across the Delaware River. This vessel turns end for end at every trip, in order to deliver the cars at the same end they entered, performing the manœuvre in a strong current often choked with ice, in from 1 min. 25 sec. to 1 min. 30 sec. with the utmost ease and precision. I might add numerous other instances to prove the invaluable properties of this method of propulsion, as adopted in America, did time permit. I must not, however, omit to mention, that the celebrated Stephen's Battery, and many gun-boats now building with fixed turrets, are being fitted with twin screws worked by separate and independent engines.

Although the method hitherto adopted for fitting twin screws has been productive of great success, as lately proved in this country by the *Flora* and *Kate*, I am satisfied that the system has been by no means fully developed in those vessels. They were confessedly not calculated for high speed, though the speed they did attain was high in comparison to the power employed, and they were too narrow to produce the greatest power of manœuvring due to the system. The diagram represents the after body of a single keeled vessel fitted with twin screws as in the *Flora*. The propeller shafts are led through the quarter of the vessel in pipes supported at their after extremity by **V** brackets bolted to the quarters and intervening dead wood. In these brackets are placed the bearings, the screws being attached to the shafts in the ordinary manner abaft the brackets.

This method I consider open to the following objections:—

1st. The shafts are liable to injury on coming in contact with floating wreck. In rising and falling in a sea they will be likely to buckle and vibrate, the unsupported length being considerable.

2nd. Wreck, weeds, or cordage getting between the pipes and dead wood can hardly escape being retained there by the brackets, and thus foul the screws or injure the shaft. Lastly, these outrigger brackets must present great obstruction to propulsion and create vibration, which will be increased by the arms of the screws passing them at 100 revolutions. This will soon produce its effect on the rivets securing the brackets to the bottom.

If it be deemed advisable to apply twin screws to existing single keeled ships the method I propose will materially reduce these objections. The pipes or trunks in this vessel are of considerable diameter at their junction with the quarters, gradually diminishing to the diameter of the boss of the screw at the after extremity. These trunks are connected with the bottoms by a strong vertical web, which supports the trunk through its whole length (instead of merely at each end), thus giving great strength and rigidity; the screw-boss fits closely to the end of the trunk which overlaps slightly to keep out small ropes, &c., and being of rather less diameter than the trunk, the water already displaced by the ship flows direct to the blades in an uninterrupted volume. The blades of the propeller being calculated to throw off objects, and there being no intervening obstruction, as in the case of the "out-rigger brackets," the risk of fouling or injury is materially reduced. The four-bladed spiral propeller shown will have a continuous and regular action on the water, tending to reduce the vibration observed in those of two and three blades, as recent experiment has proved.

Although very good results may be attained by this application of twin screws to single keel ships of the present form, the intervening dead-wood is a decided obstruction to their perfect action; it divides and materially reduces the column of water coming to the inner arms of the screws, increases friction, and the water being thrown off by centrifugal force against the dead-wood, gives a series of shocks that will tend to produce vibration. It also necessitates a leaner after-body than is required for the clear delivery of the water, thus neutralizing one of the advantages I claim for the twin screw system. By placing a screw under each quarter, in lieu of the centre of the run, the screws are taken to the water instead of leading the water to them, as in the single screw; you are thus enabled to give a fuller, more buoyant, and stronger after-section, that will give a support aft, which will prevent squatting, or undue immersion at high speed, and contribute to easy motion, whether in pitching, sending, or rolling.

The diagrams and models on the table illustrate the method by which I propose to fit these screws. You will observe that the dead wood, stern post, and ordinary rudder, are entirely dispensed with, the screw shafts being led through trunks connected to the quarters by vertical webs, similar to those I have previously described. Under these trunks are fitted two cellular keels (*a*) of any required width and depth, running under each bilge nearly the whole length of the bottom; these keels will contribute very materially to the security of the trunks, the rigidity of the after-body in the wake of the screws, and to the general strength of the bottom, which they will defend on taking the ground and decrease rolling. Under canvas they will give great stability and weatherly qualities, acting in fact as lee boards. At their after extremities are fitted two rudders, the united area of which may be in excess of the immersed portion of the ordinary rudder in a single keel ship. These subaqueous rudders act in unison or separately as may be required; being constantly submerged they are not liable to injury whether under weigh or at anchor, as is the case in the ordinary rudder. I may here mention that the rudders of the *Royal Albert* and other ships, when lying at anchor in the Crimea, was so injured by rolling as to necessitate its being unshipped. The perforated rudders shewn in the diagrams are similar to those used with great effect by the Chinese. They reduce the lateral pressure without injuring the steering power, less power being required to steer with.

It will I think be admitted that in this method the water will have a more undisturbed passage to the screws in all directions than in the single keel ship with the dead wood, and that being undisturbed, and the screws having more space to work in by the absence of the dead wood, their efficiency will be enhanced whether in propelling or manœuvring, the area of resistance to turning being decreased by the absence of the dead wood. The rudders being before the screws are acted on by an undisturbed current of water passing along the keels. Screws and rudders are thus quite independent of each other, respectively producing their maximum effect, both being immersed at such a depth as to avoid most of those dangers to which the rudder and propeller of a single screw ship are liable from floating wreck, shot, and other contingencies. The screws being deeply immersed would be nearly if not quite below the surface at light draught, thus obviating the necessity for trimming by the stern to immerse the screw, a plan of necessity adopted in many light merchant ships, which destroys their other sea-going qualities.

In this construction a duplex system is observed throughout, the ship could not, therefore, be deprived of the services of her propelling or steering power at one blow, for even if one screw should be disabled in action, a contingency not very likely to occur from their position and deep immersion, the other would still remain to propel the ship, which it has been proved can be done effectually, the *Flora* having made a portion of her passage to America working her screws alternately. If the rudders were carried away, which is even still more unlikely, the steering power would remain perfect by means of the screws.

The absence of these properties constitute the chief defects in our war ships as steamers, most of which require from 8 to 10 minutes to complete a circle of from 10 to 20 times their length in diameter, incapacitating them from manœuvring rapidly in the face of an enemy at sea, and totally preventing the performance of such evolutions as would be required to make them efficient in narrow waters, even if their great draught permitted them to enter; whereas ships of moderate draught of water, fitted on the twin screw principle, having high speed, and the power of turning and manœuvring which has been proved, would always be ready for service in shore or at sea, where the present class of ships with the single screw, and attendant heavy draught of water, would be comparatively useless. It is very obvious that if the requirements of our iron clad leviathans are to go on increasing in the proportion we are sometimes told, we must have increased displacement, and as the limit of both length and depth are well nigh exceeded, increased beam is the only alternative. With increased beam the difficulties of the single screw system multiply, and the advantage of the twin screws will be more thoroughly developed.

I am not, however, disposed to believe that such enormous ships are the best, and infinitely prefer one of moderate size that can be readily handled. Still more am I opposed to returning to the long, narrow, deep style of ships which I hear sometimes advocated, well knowing that such ships can never make good sea boats, even if they are found to roll more easily than wider ships, which I much doubt if the latter are properly constructed and weighted.

Heavy draught of water must be admitted to be a great drawback to a war ship. It is felt almost every day at our naval ports, where millions will have to be expended in suiting them for these ships, whereas ships equally, if not more efficient, might be built, for which the present depth of water would be ample.

One of the most important features in this system is its bearing on the question of "broadside batteries." By it, existing ships having broadside guns may be made to accomplish all that is claimed for the cupola or turret system, without altering form or rig, and without risking the loss of their sea-going qualities, a point that to my mind has not been satisfactorily disposed of in any argument I have yet heard on the cupola system, but that is of vital importance if we are still to rule on the wave.

Among other recommendations which the twin screw system offers both for ships of war and merchant vessels, is the division of the engine power, substituting lighter, less costly, and more manageable engines, for those ponderous machines which, while we admire them for their excellence of workmanship, cannot fail to suggest their unsuitableness for sea-going purposes.

These duplex engines also lie lower in the ship, and thus tend to counterpoise the armour plates, and their weights are also more equally distributed over the floor than with a single pair of engines.

Apart from the other advantages I have claimed for this system, it is superior in an economical point of view. The stern post of a ship costing £250,000 is estimated at £6,000, which is nearly 2½ per cent. of her total value. The weight and the difficulty of connecting it firmly with the plates of the stern, the time it takes in preparing it (in some instances twelve months), and then, perhaps, faulty, present formidable objections, whereas, in the form I advocate, the whole structure is composed of plates of equal strength readily put together, which, as a whole, forms a lighter and stronger fabric, that, if required on an emergency, might be half completed ere the massive forging was out of the smith's hands.

The ship thus relieved from these enormous weights at her after extremity, will be better calculated to carry her armour plates, and prove a better sea boat. Not only are the before-named weights dispensed with in this system, but those still necessary are removed further from the extremity, and, therefore, bring less strain on the after body, and are further removed from danger of whatever description. The weight of both the screws I advocate would be about half that of the *Warrior's* single screw.

Although not favourable to using lifting screws, (especially as they may be made non-fouling)—many objections having been raised to the twin screw system for sea-going ships from the supposed impossibility to lift them—my attention has lately been turned to that branch of the subject, and I have the pleasure on this occasion to offer to your notice a plan which, when matured, will, I anticipate, prove effectual. I produce it now in its crude form, not for an instant doubting that your friendly criticism will furnish me with valuable hints towards the accomplishment of my object.

The diagrams on the wall represent a longitudinal and two vertical transverse sections of a ship of 6,500 tons, having 62 feet beam, 400 feet on the water line, and 23 feet draught of water, showing the method of lifting the screws.

In constructing ships according to this plan, I insert two transverse bulkheads across the stern part of the ship, the aftermost of these bulkheads being immediately before the screw, and I form a well-hole for receiving each screw under the counter and abaft the after transverse bulkhead.

For the purpose of enabling overhung screws, according to this plan, to be raised vertically, I fix each screw upon a short length of shaft which is supported by, and free to revolve in, a long bearing formed by two half-carriages which, when brought together, form a tube which may be filled with lignum-vitæ strips, or other bearing or wearing surfaces. These half-frames, when combined, form the carriage, which, sliding in a vertical frame or guides between the transverse bulkheads, enables the screws to be raised vertically, so that the ship may sail without the obstruction offered by the screw propeller. Each screw may be raised separately. The inner end of the short shaft, upon which the screw is mounted, may be filled with the ordinary cheesehead coupling.

The withdrawing the screw from the water, or the lowering, may be effected by means of chains and pulleys, or any other of the well-known mechanical means may be adopted for that purpose. The foremost of the transverse bulkheads is fitted with a stuffing-box for the screw shaft, and the cheesehead coupling projects therefrom.

The apertures for the screws are fitted with flaps or shutters, opening outwards, or they may be made to slide for the purpose of closing the opening at the bottom of the screw hole, so as to insure a clear delivery of the water, whether under steam or sail.

The overhanging end of the screw or one of the blades may have a hole formed therein, for the purpose of enabling the screw to be fished, to assist in lifting it.

For the purpose of withdrawing the overhanging screw horizontally from off the screw shaft in twin screw vessels I form the after end of the screw shaft in the following manner:—I make the shaft at the outer end sufficiently large to enable it to be bored for the purpose of receiving the shank of the screw, or a short length of shaft upon which the screw has been fitted; and by means of a gib, key, or cotter, passing through key holes or slots formed in both the screw shank or shaft and the hollow part of the main shaft within the stuffing-box, or between the outer and inner bulkheads or forward of the stern bearing, the key or other means of securing the overhanging screw in its place may be withdrawn and the screw be released.

By the arrangement of bulkheads, forming the after termination of the hull in the manner described, I am enabled to give additional strength to the ship as a structure; and by the arrangement and disposition of the stern parts externally, and of the rudder in double keeled vessels, I am enabled to avoid the necessity for any stern-post, upright, or framing piece abaft the screw propeller, or any opening or void, such as exists in ships of war and other vessels, between the fore and after stern posts, which impairs the steering qualities of the ship.

In iron screw vessels, having double keels, I place a rudder in the line of each keel, and nearly in a line with each screw shaft, and I connect the tillers together so as to enable them to work simultaneously with one wheel or they may be readily disconnected, for the purpose of being worked separately.

The remaining diagram represents an adaptation of this plan of lifting to a single keeled ship, such as the *Warrior*, fitted with twin screws, and the same ship fitted with a single screw. In the former the screws will be each 15 feet diameter, will be immersed 8 feet, and four feet clear of the bottom, each weighing about 5 tons; whereas, in the latter, the immersion of the screw is only 2 feet, having 1 foot clearance at the bottom, and weighs upwards of 20 tons.

This ship is fitted with two cellular keels, and the continuous cellular bottom composed of longitudinal beams or stringers with transverse plates forming the cells as recommended by Mr. Roberts in 1852, and now generally adopted. This cellular bottom is worked up into the engine frames and forms a network of great strength, which, with the assistance of the keels, will bid defiance to any strain that may take place in that part of the fabric, the keels protecting the bottom plates from injury on taking the ground, and thus removing one of the strongest objections raised against iron construction. The keels will also keep the ship from falling over on taking the ground, whereby her guns may be fought as though afloat, and will allow the floors to be made flatter, the bilges being supported by their broad surfaces, which cannot be done in single keeled ships having rising floors like the *Warrior* and other large vessels, which only add to their weight and draught without any corresponding advantage. Docking and repairs will also be expedited by this construction, and at a reduction of 3 feet 6 inches to 4 feet draught, as compared with the *Warrior*, the present depth of water in docks will be available.

To resist the strain on the upper side of the ship—a point that many are of opinion has not been sufficiently cared for—and to protect the ship to some extent at least from vertical fire, the upper deck is also cellular, the cells being filled with a material of a non-inflammable character, harder than wood, that will not splinter, the whole being secured with through bolts and rivets as shown. With this material I propose to back the armour plates. If there is a demand for it, it can be produced in any quantity at a less cost than wood. The box girders, 2ft. deep on either side of the upper deck, are calculated to withstand any pressure that is likely to be brought on the upper part of the ship. These run fore and aft, gradually decreasing in size at either end.

The coal bunkers are formed of longitudinal bulkheads, vertical to and parallel with the keels (on which they abut), running fore and aft the ship till they meet the sides; these compartments are divided into cells of 12 ft. 6 in. square, by the main and other athwartship bulkheads; they will materially conduce to the strength of the structure, and form an important element in the unsinkable character of the ship, for in the event of either cell being perforated by a shot or a blow from a rock or a ram, that compartment alone would be filled. It might be readily repaired by the old and simple alternative of passing a thrummed sail over it from outside; on the water being pumped out by a connection with the cellular bottom, which is at a lower level, the pressure would close the aperture, and there being room to work in the cell, the plate might be repaired temporarily with screws, plates, &c., instead of being compelled to undergo the expensive and lengthy process by which the *Great Eastern* was repaired, in consequence of her double skin not admitting of such a method, there not being room to work in her cells. I consider such a cellular arrangement quite as conducive to strength, less costly, and less weighty than that of the double skin. I am informed that the *Hector* has some such arrangement. This method would also save much coal trimming, as the coals may be taken from either cell, as may be required, to trim the ship. The coal bunkers abreast the engines and boilers are carried up to the main or fighting deck, as shown in the diagram, thus distributing the weight and adding to the protection of engines and boilers.

By this disposition of longitudinal and vertical bulkheads, cells, and iron decks which strengthen alike the top, bottom, and sides of the ship, an amount of rigidity will be imparted that will effectually resist all strains from whatever direction they may come; the whole fabric being thus bound together, so that each part will bear its fair proportion of strain. I furthermore am led to believe that with such an arrangement much of the material now introduced in the form of massive ribs may be dispensed with in our war ships, and thus reduce the weight of the structure. I, therefore, advocate dispensing with nearly one-half of these ribs, providing for any additional strength that may be required for carrying armour plates, by resting them on longitudinal stringers four inches thick, with T flanges, as shown in the diagram; these will give the required strength and contribute especially to the firmness of the fore-body in resisting or giving the blow in the ram manœuvre; the armour plates require no bolts or other security than that afforded by these deep T flanges, either oakum or some soft material being caulked in between the flanges and the plates, will keep them sufficiently firm, and perhaps relieve the jar produced by the impact of shot. The form of vessel shown is very favourable to laying on the armour plates, nearly two-thirds of which may be applied without bending, the curves of the bow being of such a character as to materially reduce it even in that quarter. This description of form is being adopted in France, and would seem to be worthy of attention in the present state of the plate-bending question. The method shown of building in the lower parts of the mast to the decks and athwartship bulkheads, will also contribute to the general strength and rigidity of that part of the ship which is acted on by the rigging.

It appears to me somewhat remarkable that the application of iron decks did not take place earlier, as it forms one of the most important features in the construction of an iron ship, which, considered as a beam or girder, would be minus its upper web without an iron deck. Last year it was advanced as a novelty, and much credit was given at the Institute of Naval Architects to a gentleman who then proposed it. It would be scant justice to Mr. Roberts were I to omit stating, on this occasion, that this application was included in his patent of 1852, in connection with the arrangements of material I have endeavoured to explain, and many other clever adaptations and inventions that are now being applied, such as self-acting water-tight doors for bulkheads, plans for ventilation and lighting between decks, &c., which, like all other inventions that are seen to be valuable, have found many godfathers.

In conclusion, I would submit that, take this twin screw system of construction from whatever point of view we may, whether as a power of propelling, steering, or manœuvring our war ships with broadside guns, when engaged at sea, or with forts in narrow waters, or whether as applied to ships of commerce, where light draught and handiness are equally essential, the question assumes a magnitude and importance that demands the gravest consideration and the most ample experiment. My only regret is that the subject should not have found an abler advocate; and in thanking you for the patience with which you have so kindly listened to my remarks, I have but to express a hope that my endeavours may succeed in drawing more serious attention to it, as I feel, in common with many of my brother officers, that the time may not be far distant when our long heeled single screw ships may be called upon to act in narrow waters, and if so, will be taken at great disadvantage by vessels of very inferior force having the appliances I have described.

DISCUSSION.

Captain SELWYN, R N., rose to state a few facts in confirmation of what Capt. Symonds had advanced. Facts were more valuable than any amount of mere theory, and he had for many years past taken great interest in the proper application of the screw, because, although Captain Carpenter, who had long advocated the twin screw system of propulsion, failed in carrying it out satisfactorily—not from a want of talent on his part, but because the naval world was not sufficiently advanced to appreciate the value of this invention—he believed they should yet have reason to thank him, and such men as Mr. Roberts, who early saw to what extent this system might be developed. Capt. Symonds had shown himself worthy to tread in the path chalked out for him by his distinguished uncle, Sir William Symonds, whose labours, however they might be appreciated by those who built ships, were perhaps more appreciated by those who sailed in them; for to him was due the credit of the start, which was so difficult to make from old preconceived ideas in naval construction. Though not very advanced in years, he (Capt. Selwyn) was old enough to remember the changes which that officer introduced, and which every seaman remarked in the adaptation of every part of the ship, the beauty of design, and the excellence of finish; in short, he might say wherever one of his ships went she was an object of interest to every naval architect. They had done a great deal more since, and they were now likely to be called upon to go still further a-head, with a rapidity which became the present railway era. They wanted, in the first place, the means of putting into a small compass, and at a moderate expense, a power which could be fitly applied under all the varying circumstances in which naval actions were fought. He need not point out that in this question was involved the whole subject of naval gunnery, for ordinary guns were of little value against a gun which required no charging. A vessel under Captain Symonds' system of propulsion was capable of being turned with wonderful rapidity, and would form a most effective ram. These ships could turn on their own centres, whereas, with the ordinary screw, this could not be effected in less than five or six times the length of the vessel, while the speed attained on this principle was not less than 14 knots an hour. These were questions of great importance. There were so many present who were acquainted with naval matters that they would easily understand what would be the effect of a smaller vessel, driven at high velocity, running into a larger one. Now, to come to the facts of which he spoke at the outset of his remarks, he might mention that he was on board the *Flora* and the *Kate* during their trials; and on both occasions full liberty was given by the builder of those vessels (Mr. Dudgeon), to test their capabilities in every point, which to those on board appeared to be of importance, and he could state that the results were most satisfactory to everyone present. The comparison of those vessels with others on the ordinary system left no doubt as to their great superiority in many important points. In the first place, at starting, the facility with which they could be turned was exemplified by the fact of another steamer which was leaving the wharf at the same time occupying nearly the whole breadth of the river in turning, whilst the *Flora* was turned round short, close to the wharf. If that were the fact, the case of the *Indianola*, referred to in the paper, was but one illustration of the destructive effects which small vessels, possessing these capabilities, could produce upon much larger vessels worked upon the ordinary system, or even worked upon this system. A large ship, costing a million of money, might be successfully attacked by two or more small vessels, costing only forty or fifty thousand pounds apiece; and even if she had the two screws, her length would prevent her from competing with the smaller ships in rapidity of turning. The effects of such an attack were illustrated in the case referred to by Capt. Symonds in his paper, which showed the powers of those smaller vessels in attack, in consequence of the rapidity with which the blows could be inflicted upon the enemy. In addition to this, there was another question to be considered, which was adverted to on another occasion by the gallant admiral in the chair. Looking at the vast extent of commerce to be protected by this country, our ships were required to be ubiquitous; it was, therefore, not so much a point of size of ships, as of number of ships. The commerce of this country extended to every quarter of the globe, and was found in every sea; and, looking to the exploits of the *Alabama*, they saw what we might have to do, in the event of a war, with regard to the protection of our wide-spread commerce. But we could not do this with a limited number of large ships; what was wanted for such a purpose was small, efficient ships, which might be everywhere, and almost in two places at the same time if necessary. Naval officers would be content to forego the glory of working large ships. and trust to the people of this country for laudation, if they could only accomplish their object. The system advocated by Captain Symonds, for lifting the screws. was, he thought, as compendious as such a system could be. The application of steam in marine propulsion was, doubtless, capable of immense improvement. It was desirable to economise heat more than was done at present in our steam vessels, and when he saw a flame six feet high rising from the funnel, it occasioned him some regret for the loss of a large per-centage of fuel. To this point attention ought to be called, inasmuch as there was a limit to the capacity of vessels for carrying coals. The question before them was, how, in these ships, the conditions of obtaining the greatest amount of power with the smallest amount of fuel could be fulfilled. The mechanical question was one he would not enter into in the presence of such an authority as Mr. Roberts advising Captain Symonds, but he could not withhold the expression of his entire concurrence in the mechanical arrangements adopted in the present instance to secure strength.

Capt. A. Henderson expressed his approval of Mr. Roberts's design of a vessel, which he carefully examined seven or eight years ago. It combined the advantages of the double screw with a vessel of large beam and moderate draught of water. His experience had taught him that vessels of large draught were unfit for blockading purposes. Capt. Henderson referred to a form of vessel, designed by him twenty-two years ago, for navigating the tortuous and rapid rivers of India, in which, in order to prevent running ashore, he fitted a rudder in the bow as well as the stern. One of those vessels, the *Assam*, could be turned half round in fifteen seconds. In 1859 he built a vessel of 1,000 tons for the East India Company. The length was 225 feet, and it was fitted with one screw, with bow and stern rudders. She could turn in less than three minutes with one rudder, and in less than two minutes with both. It was important for gunnery purposes that they should be able to point the gun by the ship. If they combined the double screw and the single rudder they would gain many advantages. The vessel would turn in a smaller space, and he believed she would steer with less resistance. The common rudder, when put hard over, occasioned great resistance, to obviate which he proposed to use a balanced rudder, a combination of which, with the double screws, would be the best for large ships.

Mr. Newton Wilson would take the opportunity of mentioning a few facts, which he believed were not generally known, with regard to the advantages of the system brought before them this evening. The plan of the double screws had been adopted in America with great success. In 1845, a vessel upon this plan was built at Boston from the designs, and under the superintendence of, the American engineer, Ericsson. It was built at the cost of the insurance companies in Boston, and launched in August, 1845. This vessel was used for many years in and about the harbour of Boston for the purpose of rescuing ships which had got into dangerous positions. It was found that by means of the twin screws the most intricate passages of Boston harbour could be successfully navigated by this little vessel. It could turn in its own length in a remarkably short space of time, and it had been computed that many millions of dollars had been saved to the insurance companies of America by means of that vessel. She was sent out whenever there was a gale of wind, and brought in vessels which were in a dangerous position. On one occasion she succeeded in rescuing one of the Cunard steamers from a position of difficulty, and brought her safely into Boston harbour. This vessel was continued in that service up to the commencement of the American war, when she was bought by the Federal Government, and fitted as a gunboat. She was present at the battle of Roanoke Island, and continued in the capacity of a gun-boat, doing good service, up to the last winter, when she was wrecked on one of the bars in the neighbourhood of that island. It was, therefore, evident that this plan of twin screws was an excellent one, and he thought they were greatly indebted to Captain Symonds for having brought this interesting subject before them.

Mr. Zerah Colburn inquired if that vessel was fitted with double engines?

Mr. Wilson replied she had distinct engines, shafts, and screws. She continued in active work for seventeen and a-half years.

Captain Selwyn wished to add the remark that the great defect in the screw hitherto used was the difficulty of steering a-head against a gale of wind, from the defective area of push as compared with that given by paddles. In the present plan that defect was to a great extent remedied.

Mr. Martin said, hearing the name of Capt. Carpenter mentioned in connection with this subject, he would state that he assisted in fitting that gentleman's vessel with double screws, and was present at the trials made with her in the Thames. On that occasion it occurred to him, as it did at the present moment, that in working the double screws, the amount of friction was greatly increased—he believed it was doubled. Both screws were worked with one engine, which was ill-adapted for the purpose, and ultimately the vessel was laid by altogether. He should state that the screws were arranged differently from those of Captain Symonds. He believed that with the ordinary screw, the Government allowed three-tenths for friction, and with the double engines they would have nearly twice that amount of friction. If they could work the two screws with a single engine it would reduce the friction. He did not say it would not be better to have an engine disconnected for each shaft, but as vessels for the most part could not carry more than 14 days' fuel, he thought the double screws would not answer, as the two engines would consume a vast amount more fuel than a single one. He was present at some of the trials of the screw with the *Rattler*, and the blades of the screw were reduced from time to time, and ultimately what remained was accidentally lost. In all the experiments with that screw, it was proved that one-sixth of a turn gave the most effective result. He had gone as much into screws as most people, and he was led to believe that the form of screw propeller introduced by Capt. Symonds would not answer. The single blade screw, of one-sixth of a turn, was most effective. He was not prepared to say that Griffiths' screw was not more effective than the ordinary screw, as shown by the trials made in Stokes Bay. If it could be shown that double screws could be worked with only moderate friction, he should be very glad to hear it, and to be informed how it was done.

Mr. Richard Roberts inquired whether Mr. Martin referred to the friction of the screw in the water, or to the friction of the engine alone, or to both?

Mr. Martin replied that his remarks had reference to the machinery and the bearings.

Mr. Roberts observed that if the engines were well made the friction would be small, not more than one per cent. of the whole power. The friction of the fans in the water would be small, and they would not revolve at higher speed than the ordinary screw.

Mr. Martin added that he had tested the government engines, and had made the instruments used for the purpose, and he found the average friction to be three-tenths.

Mr. Roberts said there was no accounting for the allowances people had to make for their bad work. The friction of the shafting, if well made, would be very small indeed; and in mills it was scarcely worth taking into account. In one case he had 1,600 feet of shafting, and he considered it took next to nothing from the effective power of the engine.

Mr. Martin said he had two large steel discs made, 14 inches in diameter, which were put in for the end of the screw-shaft to work against, and the friction was so great that they almost amalgamated with the shaft. He should like to know whether such a pressure as that at the end of the shaft would not seriously detract from the power.

Mr. Roberts replied, as to the pressure melting the metals, that was from a want of knowledge on the part of the constructor; he had not given sufficient area of surface. If he had given surface enough, there would have been little friction and little tendency to heat.

Mr. Carnegie said it would be interesting to be informed of the dimensions of the *Flora* and *Kate*, by which they could judge more correctly of the performances of those vessels; also the respective horse-power of their engines.

Mr. Lewis Olrick remarked that the fact had been overlooked that at the present time they were using enormously heavy engines, in which there was great friction, although he could not agree that it reduced the effective power of the engines to the extent of three-tenths. Mr. Martin appeared to overlook the fact that the engines used for the double screws would be of a different construction, and there would be no difficulty in reducing the consumption of fuel. The great secret with regard to that was, in having a fine pitch of the screw, and with a fine pitch the engine would work at high speed, with a moderate consumption of fuel. The engines proposed for the double screws would scarcely be larger than the locomotives in use on the Great Western Railway, so that there would be a great reduction of weight, as well as of friction, and with these small direct-action engines the consumption of fuel would be much less than with the ponderous massive engines now in use. Less fuel was consumed in the locomotive in proportion to the immense power produced. With regard to the remarks of Mr. Martin as to the fact of the screw propeller used in the *Rattler* having been denuded of its blades, he (Mr. Olrick) had seen that propeller in the Patent Museum, at Kensington. Reverting to the subject of friction, he did not believe that any engine from the manufactory of Maudslay or Penn had a friction of $\frac{3}{10}$ths. It was the rule to calculate that amount of friction ten years ago, but since that time it had been reduced fully one-half. Small engines, like those which would be used for the double screws, could be made more perfect in their parts and with less friction than could be done with the larger and heavier description of engines. He begged to say, in conclusion, that the results of experiments made by him were greatly in favour of the non-fouling properties of Captain Symonds' screw.

Mr. Dudgeon believed he could state facts to show that the double screws could be worked with as little expenditure of fuel as the single screw. The *Flora* had been at work several months, at an indicated horse-power of 500, with an average consumption of 11 tons of coal in 24 hours. He did not believe there was a vessel with a double or single screw which could show a better result than that, unless using the expansion principle. The nominal horse-power of the engines was 120. He might be permitted to add that he did not believe there was a vessel afloat with the same midship section as the *Flora*, being in round numbers about 200 feet, which had a higher speed. She carried a cargo of 300 tons upon 9 ft. draught of water, at 13 knots an hour. With respect to the dimensions of these vessels, as near as his memory served him, the length was 165 feet; beam, 22 ft. 6 in.; and depth, 13 ft. 6 in. He was happy to have it in his power to corroborate all that had been said with regard to the steering powers of those two vessels. Although only provided with the ordinary rudder, their steering was perfect. The American experiments alluded to by Captain Symonds showed that 1 minute 55 seconds was occupied in turning half round the circle, whereas, in his own case the whole circle was turned in three minutes. He was happy to be able to inform the gentleman who had spoken on the subject of friction, that he did not find any extra loss of power through the friction of the double shafting, or from the double propellers passing through the water. It had been truly stated by Mr. Roberts, that two small propellers could be made to evolve as much power as one large one, with only the same amount of friction. He had the pleasure of informing them, that on Saturday he should try another of these double-screw steamers, and he had no doubt the propelling power would be as good as that of the vessels which had preceded her. To show how much the system was becoming appreciated by the public, he could state that at the present time he had as many as eight vessels, of from 800 to 1,000 tons burden, on order, and laid down in his yards. The vessel he had just completed was named *Hebe*, and was of the same dimensions as the *Flora*.

Mr. Purdie wished to inquire what arrangements Captain Symonds had made in case of derangement of the rudder? In ordinary cases rudders, when deranged, could be worked by tackle.

Captain Symonds, in reply to the observations made, said, with respect to Mr. Martin's objection as to the increased amount of friction of the two screws, the meeting would agree with him that it was quite unnecessary for him to add one word to the remarks of Mr. Roberts on that point, to which might be added the fact stated by Mr. Dudgeon, that during all the time the *Flora* had been working she had shown better results in proportion to her size than any other vessel having the same area of midship section. With regard to the question just put to him as to how he would steer in the event of the derangement of one of his rudders, he would say there would be sufficient steering power left in the other rudder, and if both rudders were disabled he could steer with the screws.

Mr. Purdie—Suppose you have no steam?

Captain Symonds replied in such a case he should be precisely in the same condition as other ships when they had lost everything, and he could only do as they were obliged to do under such circumstances.

Mr. Purdie remarked that they had tackle to attach to the rudder above the water line.

Captain Symonds said that at present he had made no provision for attaching tackle to his rudders, but, having two rudders, and the area of either being sufficient to steer with under ordinary circumstances, he contended he had a better chance than a ship with only one rudder. He was in hopes that some gentleman would have favoured him with some criticism upon his plan of lifting the screws, but he did not, on that account, regard it as perfect. He had to thank them for the kind manner in which his paper had been received, and he would repeat that he trusted it might induce those to pay attention to the subject who were more able to do so than himself, because, as a seaman, he was satisfied. and many of his professional brethren were also satisfied, of the invaluable character of this application of two screws to ships of war certainly, and, as far as his experience would enable him to judge, they would be of great advantage to sea-going merchant ships.

The Chairman said he was sure all present had listened to this paper with the greatest interest, and in his opinion, there was no subject exceeding in importance that which had been brought under notice this evening. He believed most present were aware of the course the Admiralty had adopted on the subject. No one could doubt they had had great difficulties to contend with, inasmuch as an entirely new mode of construction was forced upon them by circumstances; but he should belie his own conscientious convictions if he did not say, the results arrived at were most unsatisfactory. They had a vast number of different types of vessels; but he believed the large ships they were now building were great evils in this respect; that as far as they knew they had a probability of meeting antagonists of 4,000 or 5,000 tons, whereas they were building ships of 9,000 or 10,000 tons. He thought ships of that size would have no functions to perform. Ships of a smaller size would not go to fight them, and on the other hand no glory was to be achieved by the victory of a ship of 10,000 tons over one of 4,000 or 5,000 tons. At the same time, when they built ships of such vast size and at so great an expense, the number of them must be diminished. They had interests to watch over and protect in every quarter of the globe, and he thought it was absolutely necessary that they should have ships equal in size, and superior in speed to all others, and that they should be numerically superior in proportion to the vast number of possessions they had to defend, which were more widely spread than those of any other nation. He thought that was of importance; and when they considered that these large ships could only turn with difficulty in large areas, there was no question that the great defect was in the steering; and if the remedy for this were the only advantage proposed by Captain Symonds, it was one that they ought gladly to accept. He had no doubt, under existing circumstances, two or three ships of smaller size would be fatal antagonists to such vessels as the *Northumberland* and *Minotaur*, with only one rudder, and without proper means of turning. The subject therefore was one worthy the attention of every Englishman, and what they had heard from Capt. Symonds this evening pointed, in his opinion, towards the direction in which they must look for a remedy. He had no doubt the plan now before them would be adopted before long, and he thought the sooner the better. Capt. Symonds had given his reasons in support of his plan, and no objection had been raised against it which possessed any weight. With respect to steering, the advantages were obvious, because a ship with a single screw, if she lost her rudder, would not only not steer, but her screw would turn her round and there would be no counteracting influence whatever In the plan of Capt. Symonds, if she lost one rudder, she would have another left to steer by, and if she lost both rudders, she could be steered by means of her screws. The subject was altogether one of great interest, and he was sure they would all cordially support him in returning thanks to Capt. Symonds for his most valuable paper.

The vote of thanks having been passed,

The Secretary announced that on Wednesday evening next, the 29th inst., a paper by Prof. D. T. Ansted, M.A., F.R.S., "On the Varieties of Combustible Minerals used, economically considered in reference to their Geological Position and Relative Value for certain purposes," would be read.

COTTON GIN FACTORY IN THE DHARWAR COLLECTORATE.

Amongst the selections from the records of the Bombay Government which have recently appeared, is an interesting report, by Surgeon-Major Forbes, the superintendent, on the Cotton Gin Factory in the Dharwar Collectorate, for the half-year ending the 31st May, 1862, with letters from the Revenue Commissioner, Southern Division. The subjects discussed in Dr. Forbes' report relate to the various experiments made under the direct agency of the officers appointed by Government, since 1829 to the present time, for the introduction into the Belgaum and Dharwar districts of American and other exotic cottons, and an improved machinery for cleaning cotton. But the most important matters noticed in this report relate to the causes of the present enormous demand for machinery; the probable supply of American cotton available from Dharwar and contiguous districts; the necessity for European agents in the districts; and the adulteration of the cotton by native dealers and the remedy. These points are noticed in the report, from which the following are extracts:—

One result of the present enormously enhanced value of cotton has been the sudden and surprisingly increased demand for cleaning machinery—the number of applicants on the register who have deposited the usual advances amounting to 591, the value of which will be 1,38,000 rupees.

The cause of this is that the money is now reaching the pockets of the ryots, and that they can afford to purchase gins for themselves, instead of depending, as heretofore, upon the dealers, to whom a large portion of them were obliged to sell their cotton uncleaned, the bargain generally depending upon the proportion of wool to seed—a point which rested upon the dealer's word, and which the ryot well knew was rarely decided otherwise than to his disadvantage.

It is very desirable that this demand for machinery should be met to the fullest extent for several very important reasons. In the first place, an adequate supply will ensure the cleaning of each season's crop in sufficient time for export before the monsoon sets in, and with the prospect of good communication and direct shipment from Sudashewghur, the produce of these districts may be expected to reach England within six or seven months from the time of its being picked from the field, instead of occupying eighteen months or two years in transit, as has hitherto been the case, much to its detriment in value, owing to deterioration of strength and colour of the fibre.

A second advantage of a full supply of machinery will be the extension of the cultivation of American cotton, it may be hoped ultimately to the entire expulsion of the native variety for export from the Dharwar district,—an object, in my opinion, much to be desired, as the latter is not only a far less profitable crop to the ryot, but with the exception of one or two localities, it is of very ordinary quality, and is chiefly made use of for admixture with and adulteration of the American variety.

A third advantage which would accrue from the ryot being in possession of ample means of cleaning his own crop would be that less of it would pass for that purpose into the hands of the sowcars and dealers, and the admixture and adulteration which is now so prevalent would to a certain extent be remedied.

The above-mentioned adulteration and admixture of inferior native cotton with the American variety during the process of cleaning is carried on openly and undisguisedly at all the cleaning establishments of the sowcars and dealers throughout these districts. Though aware of the practice, I had no idea of the extent to which it was pushed, until I paid these places a visit last season when they were at work.

A description of one of them (a large native cleaning establishment at Guddug) will serve as a general sample of the whole. On entering the courtyard, which was enclosed by a high wall on one side, was seen a large heap of very inferior and trashy-looking native kupas and near to it a pile of about the same bulk of very fair American seed cotton. The space in front of the gin-room was covered with a mixture of these two heaps, spread out in the sun to dry, and upon this mixture the gins were at work.

Samples both of the seed and the cotton taken from the gins whilst at work (here and elsewhere) were forwarded by Mr. Haywood to the Cotton Supply Association with full details.

The injury which this nefarious practice inflicts upon the character of this produce in the home market, and consequently upon the interests of this part of the country, does not require comment.

The real value of pure Dharwar-grown American cotton in the English market is no longer a matter of doubt. It has been established beyond dispute that it is quite equal to the supplies from America of what is called "Middling Orleans," which is the description of cotton most in demand, In proof of this, if such were required, quotations could be furnished from the opinions pronounced by the home authorities (both spinners and brokers) upon the supplies sent to them on various occasions for the express purpose of ascertaining this point.

Within the last five years the cultivation* of American cotton in the Dharwar districts has increased more than six-fold. There is no reason to doubt that this increase will continue. The demand for machinery (if it is fully met) is a guarantee that it will do so, in which case a short time hence the whole available area of the Dharwar cotton land will be covered exclusively with this valuable plant, and the extent under yearly cultivation, including native jagheers, will not be less than 380,000 acres, leaving about 80,000 acres of the present area of cotton cultivation for the growth of native cotton for home consumption. Bellary, Belgaum, and Raichore are immediately contiguous (where the cultivation of American cotton has already extended), and may be safely estimated at 220,000 acres more (this being not more than one-third of the area in those districts at present under native cotton). The above total area of 600,000 acres will, at 4 acres to the bale, furnish 150,000 bales of New Orleans cotton. From Mysore, which is also contiguous to Dharwar, a considerable addition ought to be obtainable before long.

Though this quantity would be but a small mite in the enormous home consumption, still it is the identical article wanted in England. Unlike other descriptions of Indian cotton it requires no alteration or adaptation of the spinning mills for its use, and in no other region (out of America) that I am aware of have the attempts at its cultivation met with the success even already attained in Dharwar and its contiguous districts.

With the experiences now being realised at home, the question of providing the further measures required for the protection and encouragement of even this extent of cultivation is one well worth the consideration of those most deeply concerned. Government can do little more in the matter; the field is now ready for private enterprise. The intervention of European agency between the grower and the consumer, to take the place of the present native dealers, is what is required; and by the opening of next season, facilities will be afforded for the introduction of these agencies such as have not hitherto existed.

Good communications to the sea-board, with the means of direct shipment thence, will remove the necessity that existed for all the changing of hands that has hitherto been found necessary between this and Bombay.

It must, however, be admitted that so long as the sowcars and native dealers are unrestricted in the nefarious practice of adulteration, which I have above exposed, the European must enter the field at a great disadvantage, in so far as that they would be able to outbid and undersell him to the extent of the difference of price between the rubbish they use for admixture and good New Orleans cotton.

Those parties would also doubtless make a strenuous effort to preserve their present monopoly, and whilst the competition lasted, they would be in a condition, without incurring loss themselves (merely by foregoing their profits), to raise the price of the American cotton to a rate with which the European could not compete.

The prevention or suppression of this fraud becomes therefore one of the most essential measures for the welfare of the cotton interests of these parts. Clause 2 of a Bill read before the Legislative Council of India on the 16th January, 1858, for the better suppression of frauds in the cotton trade of the Bombay presidency, makes the fraudulent mixing of good and bad cotton in the same bale a penal offence. This appears to me to apply exactly to the case under notice, which can bear no other interpretation than a wilful admixture of an inferior with a superior article with fraudulent intent.

In bringing this matter so prominently to the notice of Government, I beg to point out that it is a purely local evil, which does not exist elsewhere, as there is no cultivation of exotic cotton in any other part of India to lead to it; it therefore becomes a question for consideration of the local legislature.

The parties by whom this fraud is perpetrated are quite aware of the illegality of their proceedings, and have nothing to say in defence, except that they do not think it can be of much importance as no notice is taken of it.

The cultivator is in no way concerned, and any measures taken for its suppression would be a matter of indifference to him. If therefore the local government is pleased to view the evil in the light in which I have represented it, and to bring forward a legislative enactment declaring such admixture of these two varieties of cotton to be illegal in terms of Clause 2 of the said bill of the Legislative Council, I believe that a proclamation to that effect, distributed amongst the dealers, would of itself suffice in a great measure to put a stop to the practice.

At all events, it would rarely, if ever, be necessary to resort to any of the severe penalties of fine, imprisonment, &c., provided for by the above-mentioned bill. A temporary suspension of the cleaning operations of the establishment would be a more suitable punishment, and would, I believe, prove quite sufficient.

The difference between the seeds of the American and native cotton is so marked that there is no difficulty whatever in discovering their admixture in the saw-gins; the detection of this offence would, therefore, with very little trouble, become almost unavoidable.

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* Last year 1861-62, American cotton, 214,310 acres; Native cotton, 243,000 acres; total, 457,310.

Before concluding, it may not be out of place to notice the prospects of the native cotton of this country in connection with the new cleaning-machinery, upon the rolling or churka principle, which has just been constructed for its use, and which, I trust, will serve to obtain higher favour for this produce than it has hitherto met with in the home market.

During the last twenty-five years the government of India has fully appreciated the necessity of obtaining some more expeditious method of cleaning indigenous cotton than by the slow and expensive process of the native churka, and at various successive periods every temptation and inducement that could be offered was held out to obtain the desired end.

The Supreme Government at Calcutta challenged invention by offering prizes in money of large amount sufficient to induce the best mechanical skill of the country to enter the lists, and at the appointed trials many and varied inventions and modifications were brought forward; but the result proved that the task had baffled the skill of the competitors, and that the "time-honoured" churka continued to hold its sway in triumph.

One or two points essential to success had been overlooked in all these machines. and though some of them in short trials appeared to give promise of success and obtained prizes, still, when brought into practical use, it was found that they could not surpass the "churka" even in the single requirement of quantity of out-turn of work, and ultimately all hopes of obtaining such a machine seemed to have been abandoned.

For some years back I have paid very considerable attention to this subject, and after careful practical study succeeded in producing a machine entirely free from the above defects; and on proceeding to England I took with me working models of these machines and also supplies of seed cotton. I was thus enabled personally to lay these models before some of the first machinists of the country, and to explain where the former difficulties lay, and the exact nature of the article now required.

Various parties have been engaged, each introducing his own modification with regard to the application ot power, &c., but the practical result is the production of machinery which, with the estimated labour of one man, gives an out-turn of upwards of 100 pounds of cotton-wool per day, with the additional advantage of allowing no seed to pass through.

At the very highest estimate the quantity of cotton cleaned by the best worked native churka does not exceed 20 pounds per man per day of 12 hours. With such a great advantage in economy, not to mention expedition also, as well as the yearly increasing scarcity and cost of labour, owing to the amount taken up by railways and other public works, the benefit of such machinery, when it becomes generally known, will be appreciated, and the cleaning of native cotton by its use will in all probability become a separate occupation in itself.

That it will prove sufficiently profitable to engage the attention of enterprising parties may be inferred from a statement made by Mr. Landon, of Broach, who ought to be well informed, as he had practical experience to guide him. In a letter to the Secretary to Government, dated Broach, 12th January, 1858, Mr. Landon writes:—"As an instance of the superior economy of the saw-gin as compared with the Gujarat churka (which is the most effective native machine in India), I may mention that if the whole of the native cotton shipped from Broach were to be cleaned by the former instead of the latter, a saving would be effected under this head alone of more than Rs. 30,000 (three lakhs) per annum.

The saw-gin destroyed native cotton, and its value was lowered in the market; nevertheless, labour was scarce, and the Broach saw-gins driven by steam found ample employment. I was at that place in the cleaning season of 1859, and I saw the carts laden with seed-cotton crowding to the gins, and their owners striving for precedence. The exports from Broach at the time at which the above estimate of profits was taken, amounted, I believe, to about 45,000 bales per annum.

That portion of the province of Berar which is now being penetrated by the railway, yields three times the above amount of cotton, and manual labour is still more scanty. The produce, as it is picked from the field, is piled up in one large heap in the open air, where it remains sometimes for months until labour can be obtained.

When first stored in this way, from a short distance it resembles a heap of snow in whiteness. Duststorms, however, set in, and the heap becomes gradually covered with fine sand and earth, until at length one can no longer distinguish what the contents may be. A few showers of rain generally succeed those duststorms, and the amalgamation of mud and cotton is completed.

I may here observe that although the cultivation of native cotton is capable of extension to an enormous degree, yet the amount of labour available is barely sufficient to clean the quantity now produced. Any large extension without the aid of cleaning machinery, therefore, cannot be expected, and this remark is the more applicable, when it is considered that the chief increase in cotton cultivation must be looked for in new districts, such as those of Central India, where population is thin and scarcely sufficient to till the land. In a well-populated district, like Dharwar, after cultivation and picking have been disposed of, the available manual labour is wholly insufficient to clean the produce by the ordinary method, and though cotton has always been a paying crop, it was not until cleaning machinery was introduced that cultivation largely increased.

Under the disadvantages I have named, and others that might be added, with which Indian cotton has to contend, it may be truly stated that, with respect to quality alone, the consumers at home are as yet ignorant of the extent to which India is capable of meeting their wants. Its produce has not been appreciated, because it has rarely reached them in fair condition or unadulterated.

Before the present scarcity, when American cotton was procurable, Indian cotton was scarcely looked at, save for re-exportation, and this latter crisis will only tend to complete the ruin of its name and character, for it is notorious that the high prices ruling have led to admixture and adulteration which have quite eclipsed all former experience.

Anything resembling cotton which could be packed into a bale readily passed muster. I have been told, upon reliable authority, that the "sweepings" of the gin-house (formerly cast away) have been sold in Bombay at 130 rupees per candy. It is probable, therefore, that at no former period has the cotton produce of India been sent to England in a condition so unfavourable to its real character.

A very different tale might be told if the crop, from the field to the final pressing, received the same care that is bestowed upon it in America; but this need never be hoped for so long as the whole trade of the interior is left to native dealers.

When recently at home I was told by spinners, who had been in the habit of using native Indian cotton, that there was cotton in India which would suit their purpose perfectly, but that they could not depend upon uniformity of quality even in the contents of a single bale. This fact is the secret of the bad repute of Indian cotton, and it points at once to the only remedy (one which has been often enough urged by all men who had practical experience to guide them), viz., the establishment in the interior by private enterprise of European agency, capable of competing with the native dealers, in whose hands this entire trade is at present suffered to remain.

There are two objects to be attained which have hitherto been totally neglected—First, securing to the ryot the certainty that any improvement he can effect in the quality of his produce by the exercise of a little more care and trouble in cultivation and picking will bring him its reward; secondly, to provide the means of protecting the produce from adulteration until it has been finally pressed for export.

That these should be the work of private enterprise no one will dispute, and until it be attended to all the aid that is so loudly called for from Government may be granted tenfold. The country may be interlaced with roads, railways, and canals, but the prospects of its cotton trade, in so far as the requirements for home consumption are concerned, will be in no way improved.

I have reason to know that the correctness of these remarks is no longer doubted by parties at home who have given the subject fair and unprejudiced consideration, and who are not unwilling to provide the means for establishing the agencies required; but they are deterred from commencing operations under the impression that India is not yet prepared for such an enterprise.

It is right, however, to state that such is not now the case; the impediments which formerly existed are rapidly being cleared away, and even within the last twelve months facilities have been opened out which afford ample room for immediate action.

The province of Broach (one of the finest cotton districts in this presidency) has rail and water communication with the shipping in Bombay harbour. Sholapoor is opened out, and has its railway carrying cotton to the same port. So likewise with Berar, where in a short time the only interruption will be about eleven miles on the Thull Ghaut, which, with the railway arrangements, will give very little trouble; and the Southern Maratha country and Dharwar districts have new facilities such as they never enjoyed before; these alone are more than sufficient to encourage an immediate commencement.

I have stated above that the number of gins now applied for amounts to 591, over 200 of which have been ordered within the last month. I should now mention the means available as well as the measures which have been adopted to meet this demand. On the 11th April last I applied for the sanction of Government to enable me to procure from England a supply of iron-castings for 300 gins, and I received a reply granting the required sanction, from which I have been able to send the necessary orders home by the mail which left Bombay on the 27th May last. I have also forwarded, on the 29th May, a second application for permission to obtain a further supply of 300. These, when received, will suffice for the parties who have already applied.

To meet the further demand which may be anticipated, there is supply of material now arrived in Bombay (independent of that which has been lost by the wreck of the *James Pilkington*), which, when received, with the aid of other resources, will enable the factory to have upwards of 100 gins ready for distribution in time for next year's crop.

I may here mention, that though the Home Government advances the money required for the necessary materials, the State is in no way a loser by these transactions. The articles obtained from England embrace only such portions of the machine as are best made in cast-iron; the remainder, along with the furnishing and fitting up, is completed at the factory, where the charges for work done are so framed as to cover every possible expenditure, including superintendence.

On referring to the returns, I find that during the six years ending 6th June last, the receipts realised have fallen short of the expenditure by a sum of 1,280 rupees, making 213 rupees per annum, or 17¾ rupees per month, the sum which for that period has been the sole cost to Govern- of the Dharwar cotton establishments, and even this deficiency is due to partial suspension of gin-making, pending the receipt of iron materials from home. The sale of the extensive supplies now in the country or ordered, will more than cover this deficiency.

Before closing this report, which mainly relates to the extension of New Orleans cotton, it may be as well to give an approximate estimate of the quantity of native cotton which may be reasonably looked for from the cotton fields of the Southern Maratha country and adjacent districts, for which Sudashewghur forms the natural outlet. In this I include all the cotton land situated within about 200 miles of that port.

We have pretty accurate data of the area under cotton in our own territories and Bellary, and can at any rate form an estimate of the area within the above distance in the adjacent territory of Raichore and Mysore. After making a deduction from the present extent under cotton for the supply of the quantity of American cotton mentioned above, there will remain in Dharwar, Belgaum, Bellary, and the southern districts of Sholapore on the Krishna, 630,000 acres for native cotton. I am certainly rather under than over the mark in putting the present cotton cultivation of Raichore and Mysore at 350,000 acres more, making a total of 980,000 acres, which, at the moderate estimate of seven acres to the bale, will give 140,000 bales of native cotton, which, with the amount of New Orleans cotton, estimated above, gives a total of close upon 300,000 bales as the cotton available for export from Sudashewghur. The facilities afforded for export, and an increased supply of cleaning-machinery, will, doubtless, add very considerably to this amount.

ROYAL NATIONAL LIFE BOAT INSTITUTION.

From the annual report of this institution, just published, it appears that during the past year the society had placed fourteen new life-boats on the coast, viz:—at Blakeney, Kirkcudbright, Kingstown, Poolbeg, Howth, Withernsea, Thorpe, New Brighton, Appledore, Guernsey, Porthleven, Tynemouth, Fleetwood, and Newhaven; six of this number occupying new stations, and the remainder replacing worn out or inferior boats. Other life-boats were in course of construction for Budehaven, Swansea, and other places. Transporting carriages and substantial boat-houses had been provided for all the life-boats. Six life-boats had also been built for the Portuguese government, by Messrs. Forrestt, on the Institution's plan, and one for the Colonial government of New Zealand. The Institution had now 124 life-boats on the coasts of the United Kingdom. Of the fourteen new boats placed on the coasts during the past year, no less than eight had been the special gifts of individuals, and another, that at Thorpe, in Suffolk, was presented to the society by the town of Ipswich. The life-boats of the Institution during the year 1862, had saved 358 persons from wrecked ships, nearly the whole of them under circumstances of imminent peril, when no other description of boat could have performed the service. For these services the Institution had granted rewards amounting to £915 18s. 1d. On these and quarterly exercise, the life-boats had been manned by upwards of 6,000 persons, and happily, with one single exception, without loss of life. During the past year, 4,081 lives had been saved from shipwrecks on our coast. The total number of persons saved from shipwreck, from the establishment of the Institution in 1824, to the end of the year 1862, either by its life-boats, or by special exertions for which it had granted rewards, is 12,854. During the past year 13 silver medals, 14 votes of thanks inscribed on vellum, and £1,125 8s. 1d. had been granted by the Institution for saving the lives of 574 persons by life-boats, shore-boats, and other means, on the coasts and outlying banks of the United Kingdom. Since the formation of the Institution it had expended on life-boat establishments £67,780, and had voted 82 gold and 718 silver medals for saving life' besides pecuniary awards, amounting together to £16,478. The committee expressed their deep acknowledgments to the Board of Trade, the Coast Guard, the Local Committees, the Railway and Steam Packet Companies, for their continued valuable and zealous co-operation. The total receipts of the Institution during the year 1862, amounted to £14,825 5s. 1d.; of that sum no less than £2,715 was given by benevolent individuals to defray the cost of ten life-boats. The committee gratefully acknowledged the receipt of special contributions from foreign countries: £100 from the President of the United States of America; £50 from the Maritime Insurance Company of Finland; £251 15s. from China. The following legacies had been left to the Institution since the last report:—Miss Ann Cullo, £1,000 free of duty; T. A. Venables, Esq., of Worcester, £500; Mr. John Jolley, farmer, Oxfordshire, £210; Mr. Thomas Robinson, commercial traveller, of Cheetham, Manchester, £210; Dr. C. T. West, of Kingston-upon-Hull, £100; William Lupton, Esq., Salford, £100; Miss Alice Gedge, of Great Yarmouth, £100. The expenditure of the Institution during the same period was £14,247, of which sum £5,269 6s. were expended on additional life-boats, transporting carriages, boat-houses, and necessary gear, and £3,977 0s. 4d., on the necessary expenses of repairs, painting, refitting, and inspection; £1,094 6s. 1d. in rewards for services to shipwrecked crews; and £2,242 9s. 10d. for coxswain's salaries, and the quarterly practice of the boats' crews. The committee had incurred further liabilities, amounting to £3,100 6s., for various life-boat establishments, &c. No society had a stronger claim for general sympathy and support than the National Life-boat Institution, whose life-boats, under Divine Providence, had so often preserved to an otherwise desolate home a husband, father, or brother. The committee therefore appealed with confidence to the country at large to assist to maintain a state of thorough efficacy the 124 life-boat establishments of the Institution.

Home Correspondence.

COTTON SUPPLY.

Sir,—The evening when Mr. Cheetham favoured the Society with his valuable paper "On the Present Position and Future Prospects of the Supply of Cotton," I took the liberty to offer a few remarks on the capacity of Italy to produce large quantities of cotton, basing my observations on the fact—

1. That Italy possesses a considerable quantity of land capable of producing cotton.
2. That she has for a long time produced cotton, and the growers are therefore accustomed to that cultivation.
3. That Italy has a large population, with labour remarkably cheap; and, above all,
4. That new life and energy have been introduced into all the affairs of the kingdom, whether political or economical.

I have therefore much pleasure in sending you a translation of the decree appointing a Royal Commission for Promoting the Cultivation of Cotton in Italy; and it will be gratifying to the Society to see that the president is the Commendatore Devincenzi, who was the Italian Commissioner to the International Exhibition in 1862, and who has himself shown so much ability and energy in bringing the subject before the public in this country. I am, &c.,

LEONE LEVI.

Farrars-buildings, Temple,
April, 1863.

Report of His Excellency the Minister of Agriculture, Industry, and Commerce, on the Formation of a Royal Commission to Promote the Cultivation of Cotton in Italy.

Sire,—Now that Italy has risen politically and has become a great nation, it is the more necessary that she should also rise economically, and that she should return once more and with alacrity to her old path of industry and commerce. The life of modern nations consists in the development of public wealth, and the political and economical power of a state are generally united. Whatever be the difficulties we have to contend with, certain it is that the many advantages we possess from soil and climate, and from the altered condition of trade, cannot fail to enrich the country. We trust that the same energy and perseverance which have so wonderfully led to our political regeneration, will place us soon among the most prosperous nations. And we are persuaded that the Italian nation already feels strongly the need of advancing with energy in economical progress, and of bringing public wealth to the level of our political standing. The government of your Majesty cannot but second with all the means at its disposal this great national want, and we deem it desirable to turn our attention especially to the southern states and to our great islands as parts of the kingdom, which, having hitherto been left uncared for, may contribute to a speedy and large increase of national riches.

The cotton industry is very extensive, it being a textile material used for the clothing of the greatest number of people. The power of two of the greatest nations is principally based on the cotton industry. The United States gathered in 1860 upwards of 4,500,000 bales of cotton, representing a value of 1,000 millions of lire; and England exported in the same year cotton manufacture amounting to upwards of 1,300 millions of lire, which constitutes 38 per cent. of the total exportation of that rich country.

The American war having rendered the produce both scarce and dear, a rare opportunity is affored to try if it be possible to promote among us a large cultivation of cotton. The first attempts always demand large expenses, which are at first discouraging, but the extraordinary prices now ruling may render even such attempts remunerative.

The cultivation of cotton in Italy is very ancient. Before the gigantic changes produced in the cotton industry by the introduction of new and wonderful machinery, and by the extensive cultivation in America, Southern Italy cultivated, spun, and manufactured cotton very largely, During the French Empire, the continental blockade having thrown hindrances on the cotton and woollen trade of America, considerable impulse was given to this cultivation in these regions. And although, when the blockade was removed, the extraordinary reasons which favoured it ceased to exist, still it was not abandoned altogether. In Sicily, in Ottronto, and Pau, and in the Principati Citeriore, 40,000 to 50,000 cwts. of cotton were annually obtained till very lately.

In the southern provinces and in the islands we have great abundance of land, as yet of little value, suitable to this cultivation, with a large population, whose wages are very low; and an excellent quality of cotton acclimatised from the most remote times. And it may be added that the greater part of the territory adapted to cotton cultivation will be very soon traversed by railways. Among the benefits which we have reaped from the part we have taken in the International Exhibition of 1862, certain it is that the first was the opportunity offered to the Commissioners of your Majesty to bring before the public and to study in all its bearings this great economical question of the cultivation of cotton. The important conference held in London last year of the representatives of all cotton-producing countries, and the grave discussions and deliberations which took place both at the Cotton Supply Association, the Chamber of Commerce of Manchester, and more recently at the Statistical Society of London, give ground to hope that Italy will be certainly among the countries able to supply the largest quantity of cotton.

The best means of promoting the cultivation in Italy is doubtless to facilitate, with good economical laws, the investment of capital in agriculture; and the Minister is now occupied on several measures which may lead to that end. But, that there may be persons who will more especially seek what may be done to promote the cultivation of cotton in Italy, and do what is necessary by all possible means, we have come to the decision to ask your Majesty to nominate a company.

It will be the duty of the Commission to publish the most useful information; to study the localities best adapted to this cultivation; to facilitate to the cultivators the purchase of seeds and machinery; and in general to promote whatever measure may best favour this great cultivation in Italy. We have the honour, therefore, to propose for your Majesty's approbation the following decree:—

VICTOR EMANUEL II.

By the Grace of God and the will of the Nation,
King of Italy.

Upon the proposition of our Minister of Agriculture, Industry, and Commerce, we have decreed and do decree:—

1. A Royal Commission is established connected with the Ministry of Agriculture, Industry, and Commerce, to promote the cultivation of Cotton in Italy.

2. The Commission will do whatever it may think best to promote, by means of the Ministry of Agriculture, Industry, and Commerce, all that may favour this cultivation in Italy.

3. The Commission will correspond especially with all the Provincial and Communal authorities; with the Chambers of Agriculture and Commerce; with the Institute of Encouragement in Naples and Palermo; with the Academy of Georgofoli of Florence; with the Royal Economical Societies; with the other Societies and Academies which promote the progress of agriculture, and with the directors of the Royal Agrarian and Botanical establishments.

4. The Commission will provide annually for an exhibition of samples of Cotton cultivated in the kingdom, when prizes may be given, reserving for ourselves to give special reward to those who contribute most to establish on large bases this cultivation in Italy.

5. By another decree the members of the Commission will be nominated. The same Minister is charged with the execution of the present decree, which will be registered in the Corte de 'Conti.

VICTOR EMANUEL.

Turin, 13th March, 1863.

VICTOR EMANUEL II.

In furtherance of the 5th Article of our decree of this day, by which a Commission is established for promoting the cultivation of Cotton in Italy.

On the proposal of the Minister of Agriculture, Industry, and Commerce, we have nominated the following members of the same:—

The Commendatore Giuseppe Devincenzi,
Deputy to Parliament, *President.*
Prince Pandolfina Ferdinandi di S. Giuseppe, Senator.
Conte Augusto Pannelini, Senator.
Marquis Alberto Lamarmora, Senator.
Giovanni Battista Colacchioni.
Professor Giovanni Barracco.
Professor Chevalier Pietro Cuppari.
Chev. Demetrio Castelli.
Chev. Carlo Berti Pichat.
Chev. Prof. Gian Giacomo Reymond, *Secretary.*

THE NEW ART OF AUTO-TYPOGRAPHY.

Sir,—The late hour at which the discussion on my paper, read on the 17th inst., closed, prevented the possibility of replying to every point raised by some of the speakers. Will you allow me to take up several points now?

Mr. John Leighton's allusion to the lace-printing exhibited by Mr. William Taylor, of Nottingham, in the Great Exhibition of 1851, was a little aside of the real question—even as to the progressive steps of the kind of nature-printing to which the early part of the paper was devoted, as suggestive of autotypography, viz., the transfer to a *metal plate*. Mr. Taylor transferred lace to stone, and printed from it at the lithographic press. He also embedded lace in wood. A specimen of printing from the latter can be seen in vol. vi. of the *Journal of Design* (November 1851), printed as a surface type; the lace being *white* on a dark ground. This is a very different thing to impressing lace in a metal plate, and treating it like an intaglio engraving. The former would never have suggested the art-process which formed the real subject of the paper, whilst the latter, when applied to a feather, certainly did, as stated by myself.

It seemed to be assumed by one or two of the speakers, that Peter Kyhl, of Copenhagen, had done something more than transfer natural objects. This is not correct. His process is only recorded as being one of direct nature-printing. There is nothing suggested in the MS. in the Royal Library at Copenhagen, as quoted by Mr. H. Bradbury, which leads to the inference that he did anything with drawings, or contemplated anything of the kind.

Mr. Dickes assumed that there was an analogy between nature-printing and Mr. Palmer's process of glyphography. The fact is there is no such analogy. Mr. Palmer might have made a few experiments with intaglio plates, although I have no recollection of any such attempts; but as there was nothing to be gained by such a process, his attention was mainly directed to the production of surface blocks to supersede wood engraving. Possibly the process shown by the Imperial Printing Office at Vienna, in the Great Exhibition of 1851, might have been suggested, as I think it was, by Mr. Palmer's process; this, however, was not nature-printing, but a tedious and costly process of printing a picture in colours from a series of intaglio plates.

The question of the Chairman (Mr. Westmacott) as to the practicability of using some other material than sheet gelatine for making the drawing upon, was partly answered in the paper itself (p. 376), as two methods of making a drawing on fine India paper are named; but it was shown that a tint was produced as well as the lines of the drawing. Sheet gelatine, being as smooth, on one side at least, as the plate glass it is made upon, enables the artist to execute a drawing which will engrave or impress without any tint, except what he wishes to give as part of the effects of his work. The apparent slipperiness of the surface really presents no difficulty whatever in execution; of which a trial would have convinced the speaker, as the drawing material has a chemical and mechanical affinity for the gelatine, and flows freely from the pen and brush. In fact, it can be written upon as rapidly with this material as paper can be with ordinary ink.

I am, &c.,
GEORGE WALLIS.

16, Victoria-grove, Fulham-road, West Brompton, S.W.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...R. Geographical, 8½. 1. Capt. Bedingfield, "Visit to Ode the Capital of the Jjebu Country, Western Africa. 2. Capt. R. Burton, H.B.M. Consul at Fernando Po, "Explorations of the Elephant Mountains, &c., in Western Africa." 3. Mr. W. Winwood Reade, "Travels in Equatorial Africa (Gaboon, Corisca, &c.)" 4. Lieut. Oliver, R.A., "Notes on Madagascar.'
Actuaries, 7.
Medical, 8½.
Philosophical Club, 6. Annual Meeting.
Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion upon Mr. Hawkshaw's paper on "The Middle Level Drainage." 2. Mr. Harrison Hayter, "The Charing-cross Bridge."
Royal Inst., 3. Prof. Tyndall, "On Sound."
Wed. ...Society of Arts, 8. Prof. D. T. Ansted, F.R.S., "On the Varieties of Combustible Minerals used Economically, considered in reference to their Geological Position and Relative Value for Certain Purposes."
London Inst., 12 p.m. Annual Meeting.
Thurs...Royal, 8½.
Antiquaries, 8½.
Royal Soc. Club, 6.
Royal Inst., 3. Prof. Ansted, "On Geology."

Fri.......Royal Inst., 2. Annual Meeting.
,, 8. Mr. John Leighton, "On Japanese Art."
Archæological Inst., 4.
R. United Service Inst., 3. Mr. Bonamy Price, "Venetia and the Quadrilateral."

Sat.......Royal Inst., 3. Professor Max Muller, "On the Science of Language."

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 10*th*, 1863.]

Dated 30*th March*, 1863.

816. J. Musgrave, Globe Works, Bolton—Imp. in the construction of steam boilers.
818. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in moulds to be used for casting steel or homogeneous iron.
820. J. Carver, Nottingham—Imp. in the manufacture of carriages employed in machines for the making of lace or other fabric.

Dated 31*st March*, 1863.

824. E. T. Hughes, 123, Chancery-lane—An improved composition for rendering cloth, paper, and similar articles transparent and waterproof. (A com.)
826. A. B. D Maurand, 25, Passage des Petites Ecuries, Paris—A translucid cylindric apparatus for bringing the former weights and measures into those of the present decimal system most easily and precisely. and vice versa.
828. W. Forrest and H. Duckworth, Blackburn—Imp. in looms for weaving.
832. H. Hamer, Kender-street, Old Kent-road—Imp. in tanning, and in apparatus employed therein.

[*From Gazette. April* 17*th*, 1863.]

Dated 4*th December*, 1862.

3248. C. H. Roeckner, Bristol—And improved method of constructing coffer dams and other similar structures for excluding or keeping back the flow of water and preventing inundations.

Dated 9*th February*, 1863.

355. H. G. Williams and R G. Price, Bontddu, near Dolgelly, Merionethshire—An improved machine for crushing and amalgamating auriferous quartz, and pulverising and washing ores.

Dated 11*th February*, 1863.

374. R. Saunders, Croydon, Surrey—Imp. in pavements and floors, which imp. are applicable also to stairs and steps.

Dated 2*nd March*, 1863.

580. A. F. Pagny, 15, Passage des Petites Ecuries, Paris—A new agricultural implement for cultivating tubercles, roots, and all oil plants.

Dated 14*th March*, 1863.

695. R. Alexander, Islington, Liverpool—Imp. in mariners' compasses, and the parts in connection therewith, and in the application thereof to magnetic instruments.

Dated 16*th March*, 1863.

707. J. Smethurst, Royton, Lancashire—Imp. in the construction of ships and vessels, for the purpose of obtaining additional strength and motive power.
708. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of iron and steel. (A com.)

Dated 18*th March*, 1863.

727. B. Wren, Stockton upon-Tees—Imp. in cleansing and treating certain descriptions of wheat and other grain.
728. E. Legris, Bondeville, France—A new or improved machine for thrashing out the seed of flax.
731. W. Lorberg, Wyld's-rents, Bermondsey—Imp. in the treatment of rags, and obtaining valuable chemical products from the animal fibre therein.

Dated 20*th March*, 1863.

743. R. Couchman, 26, Noble street, St. Martin's-le-Grand—Imp. in articles or means for supporting or carrying ladies' parasols, bags, or other articles or appendages.
747. V. Houghton, 2, Merton-road, Kensington—Imp. in lamps and lamp wicks. (Partly a com.)

Dated 21*st March*, 1863.

756. G. A. Biddell, Ipswich—Imp. in locomotives, usually called "traction engines," to be used on common roads.
761. W. Clark, 53, Chancery lane—Imp. in the separation or obtaining of ammonia from azoted matters in the preparation of manure. (A com.)

Dated 27*th March*, 1863.

806. J. D. Asquith and G. Greenwood, Morley, near Leeds—Imp. in rag machines.

Dated 28*th March*, 1863.

812. A. Blouin, 79, Rue du Faubourg du Temple, and D. N. Mercier, 10, Rue Richelieu, Paris—An improved axletree, with linked levers for lifting.

Dated 31*st March*, 1863.

830. R. A. Brooman, 166, Fleet-street—Imp. in electric telegraph printing apparatus. (A com.)

Dated 1*st April*, 1863.

836. I. Rowland, Salford—An improved mileage apparatus for measuring and registering the distances public vehicles or private carriages travel.
842. G. T. Bousfield, Loughborough-park, Brixton—Imp. in steam boilers. (A com.)
844. R. Gavin, Edinburgh—Imp. in the preservation of perishable liquids during the withdrawal or consumption thereof.

Dated 2*nd April*, 1863.

846. J. W. Law and J. Inglis, Glasgow—Imp. in making moulds for casting, and in apparatus connected therewith.
848. D. S. Sutherland, 34, Great George street, Westminster—Imp. in protecting vessels of war and fortifications from the effects of projectiles.
850. J. J. Potel, St. Quentin, France—Imp. in furnaces and fireplaces, having for object the consumption or prevention of smoke.
852. G. A. Cox, Lochee, Dundee—Imp. in the treatment or preparation and manufacture of jute, hemp, flax, and other fibrous or textile materials.
854. A. B. Seithen, 5, Mansfield-place, Kentish Town—Imp. in casings, covers, or wrappers for bottles, jars, and other articles.

Dated 4*th April*, 1863.

858. J. Silvester, West Bromwich—Imp. in attaching guards to pressure gauges.
860. W. E. Gedge, 11, Wellington-street, Strand—Improved apparatus for bolting flour. (A com.)
862. A. V. Newton, 66, Chancery-lane—An improved construction of pressure gauge. (A com.)

Dated 6*th April*, 1863.

864. F. C. Bakewell, 6, Haverstock-terrace, Hampstead—Imp. in wicks for lamps. (A com.)

Patents Sealed.

[*From Gazette, April* 17*th*, 1863.]

April 17*th*.

2814. R. A. Brooman.
2816. W. E. Gedge.
2819. G. Haseltine.
2821. J. Clark.
2823. W. A. Turner and T. T. Coughin.
2825. H. L. Emery.
2826. J. H. Johnson.
2831. S. Witham and T. Wright.
2832. C. G. Clarke, jun.
2834. J. T. Cooke.
2835. R. A. Brooman.
2838. G. Haseltine.
2840. C. Tress and F. C. Belhomme.
2842. J. Spence.
2848. T. Fearn.
2860. E. H. Carbutt and G. A. Clough.
2887. F. Lipscombe.
2909. G. Darlington.
2912. W. Clark.
2939. G. Dickinson & E. Cooke.
2946. G. Speight.
2965. L. Gonez.
3032. W. E. Newton.
3033. J. Easton, jun., and J. C. Amos.
3146. A. V. Newton.
3190. F. Boecke.
3264. T. E. Blackwell.
257. J. H. Johnson.

[*From Gazette, April* 21*st*, 1863.]

April 21*st*.

2851. J. T. Stroud.
2852. W. S. Gamble.
2853. A. Chaplin and G. Russell.
2858. H. Ree.
2862. R. A. Brooman.
2870. P. S. Devlan.
2871. G. Luke and W. Luke.
2873. W. Owen.
2883. J. Chattwood.
2886. H. C. R Joubert.
2888. W. J. Williams.
2890. F. L. H. W. Bunger.
2913. W. Clark.
2948. T. Gibson, T. Hall, and T. Davison.
2958. E. Stevens.
2963. J. Musgrave.
2968. E. Humphrys.
3011. W. Clark.
3034. T. G Ghislin.
3106. R. Mushet.
3156. N. J. Amies.
3195. J. F. Delany and J. C. R. Okes.
3222. E. D. Johnson.
3418. M. Clark.
160. Sir W. O. Brooke.
176. S. Blackwell.
191. N. Clayton and J. Shuttleworth.
270. N. Clayton and J. Shuttleworth.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, April* 21*st*, 1863.]

April 13*th*.

922. J. Platt.
933. J. J. L. Bremond and L. Z. Thuilliez.
939. A. Jones.

April 14*th*.

943. Sir J. S. Lillie.
1124. J. Grimond.

April 15*th*.

958. T. Turner.

April 17*th*.

974. J. Fowler, jun., W. Worby, and D. Greig.
980. B. Lauth.
984. J. Willis.
1083. H. Rawson.
1088. G. T. Bousfield.
1090. H. Hutchinson.

April 18*th*.

1020. D. G. Berri.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, April* 21*st*, 1863.]

April 13*th*.

897. W. Smith.
948. J. Nasmyth and H. Minton.

April 16*th*.

923. W. Tytherleigh.

April 18*th*.

989. F. W. Blacket.
1194. A. V. Newton.